

CLAIMS

1. A method for polishing a substrate feature comprising the steps of:
 - (a) applying a polishing composition to a polishing pad wherein the polishing composition includes a solution comprising at least one functionalized alkylsilane compound in solution and at least one abrasive;
 - (b) moving the substrate into contact with a polishing pad such that the substrate surface feature contacts the polishing pad; and
 - (c) moving the polishing pad in relationship to the substrate surface.
2. A method for polishing a substrate feature comprising the steps of:
 - (a) applying a polishing composition to a polishing pad wherein the polishing composition includes a solution comprising at least one silane in solution wherein the silane has the following formula: $Y-Si(X_1X_2R)$, dimers, trimers and oligomers thereof, wherein X_1 , X_2 and Y are each independently selected from, hydroxy, a hydrolyzable substituent and a non-hydrolyzable substituent and wherein R is a non-hydrolyzable substituent;
 - (b) moving the substrate into contact with a polishing pad such that the substrate surface feature contacts the polishing pad; and
 - (c) moving the polishing pad in relationship to the substrate surface.
3. The method of claim 2 wherein the polishing pad is an abrasive-containing polishing pad.
4. The method of claim 3 wherein the abrasive-containing polishing pad includes at least one metal oxide abrasive.
5. The method of claim 4 wherein the metal oxide abrasive is selected from the group consisting of silica, alumina, germania, zirconia, ceria, titania and mixtures thereof.
6. The method of claim 4 wherein the metal oxide abrasive is alumina, ceria or combinations thereof.
7. The method of claim 2 wherein the polishing composition includes at least one metal oxide abrasive.

8. The method of claim 7 wherein the metal oxide abrasive is selected from the group consisting of silica, alumina, germania, zirconia, ceria, titania, and mixtures thereof.
9. The method of claim 7 wherein the metal oxide abrasive is silica.
10. The method of claim 2 wherein Y is hydroxy ($-OH$) or a hydrolyzable substituent, X_1 , and X_2 , are each independently selected from hydroxy, a hydrolyzable substituent, and a non-hydrolyzable substituent, and R is a non-hydrolyzable substituent wherein each of the non-hydrolyzable substituents are independently selected from the group consisting of alkyl, cycloalkyl, aromatic, functionalized alkyl, functionalized aromatic, functionalized cycloalkyl, alkenes, disilane, and trisilane, one or more of which carbon atoms may be substituted with one or more atoms selected from oxygen, nitrogen, sulfur, phosphorous, halogen and combinations thereof.
11. The method of claim 10 wherein X_1 , and X_2 are each selected from the group consisting of hydroxy or a hydrolyzable substituent.
12. The method of claim 11 wherein R is selected from the group of compounds including alkyl and functionalized alkyl.
13. The method of claim 11 wherein the silane compound is selected from the group consisting of glycidoxypentyltrialkoxysilane, isocyanatopentyltrialkoxysilane, ureidopentyltrialkoxysilane, mercaptopentyltrialkoxysilane, cyanoethyltrialkoxysilane, 4,5-dihydro-1-(3-trialkoxysilylpropyl)imidazole, 3-(trialkoxysilyl)-methyl ester propanoic acid, trialkoxy[3-(oxiranylalkoxy)propyl]-silane, 2-methyl, 3-(trialkoxysilyl)propyl ester 2-propenoic acid, [3-(trialkoxysilyl)propyl]urea, and mixtures thereof.
14. The method of claim 2 wherein one substituent selected from X_1 and X_2 is a non-hydrolyzable substituent.
15. The method of claim 14 wherein at least one substituent selected from R and the non-hydrolyzable substituent selected from X_1 and X_2 is selected from the group of compounds including alkyl, functionalized alkyl, and mixtures thereof.
16. The method of claim 15 wherein the silane is selected from the group consisting of chloropentylmethyldialkoxysilane, 1,2-ethanediylbis[alkoxydimethyl] silane, dialkoxymethylphenyl silane, and mixtures thereof.

17. The method of claim 2 wherein X_1 and X_2 are each non-hydrolyzable substituents.
18. The method of claim 17 wherein at least one substituent selected from R , X_1 and X_2 is selected from the group of compounds including alkyl and functionalized alkyl.
19. The method of claim 18 wherein each alkyl and functionalized alkyl substituent has from 2 to 25 carbon atoms.
20. The method of claim 19 wherein at least one non-hydrolyzable substituent is a functionalized alkyl selected from the group consisting of alkyl nitriles, alkyl amides, alkyl carboxylic acids, alkyl halide, alcohol, alkyl ether, and mixtures thereof.
21. The method of claim 20 wherein at least one of the non-hydrolyzable moieties is functionalized propyl alkyl.
22. The method of claim 17 wherein the silane is selected from the group consisting of cyanopropyl dimethylalkoxysilane, N,N' -(alkoxymethylsilylene)bis[N -methylbenzamide], chloromethyl dimethylalkoxysilane, and mixtures thereof.
23. The method of claim 2 wherein the silane is selected from the group consisting of glycidoxypropyl trialkoxysilane, isocyanatopropyl trialkoxysilane, ureidopropyl trialkoxysilane, mercaptopropyl trialkoxysilane, cyanoethyl trialkoxysilane, 4,5-dihydro-1-(3-trialkoxysilylpropyl)imidazole, 3-(trialkoxysilyl)-methyl ester propanoic acid, trialkoxy[3-(oxiranylalkoxy)propyl]-silane, 2-methyl, 3-(trialkoxysilyl)propyl ester 2-propenoic acid, [3-(trialkoxysilyl)propyl]urea, chloropropyl methyl dialkoxysilane, 1,2-ethanediylbis[alkoxydimethyl] silane, dialkoxymethylphenyl silane, cyanopropyl dimethylalkoxysilane, N,N' -(alkoxymethylsilylene)bis[N -methylbenzamide], chloromethyl dimethylalkoxysilane, and mixtures thereof.
24. The method of claim 2 wherein the solution comprises at least one solvent selected from the group consisting of water, alcohols, and combinations thereof.
25. The method of claim 2 wherein the solution is water.
26. The method of claim 2 wherein the polishing composition includes from about 0.02 to about 5.0 wt% silane.